

CHAPTER III

METHODOLOGY

In this chapter selection of the subjects, selection of variables, experimental design, pilot study, criterion measures, reliability of data, reliability of instruments, tester's reliability, subject reliability, circuit training programme, training schedule, test administration, collection of data and the statistical techniques used have been explained.

3.1 SELECTION OF SUBJECTS

The purpose of the study was to find out the effects of varied intensity and frequencies of weight training on selected motor ability components and physiological variables among athletes.

To achieve the purpose of this study, sixty athletes who represented their schools at Thiruvannamalai District Sports Meet were randomly selected as subjects. The selected subjects' age group was ranging from sixteen to eighteen years. The subjects were randomly divided into three groups and each group consists of twenty subjects. Group one acted as experimental group I and Group two acted as experimental group II and group three acted as control group. Control group was not given any exposure. Experimental Group I underwent High Intensity and Low frequency (HILF) of weight training and Experimental group II under went low intensity and high frequency (LIHF) of weight training for twelve weeks.

3.2 SELECTION OF VARIABLES

3.2.1 Dependent Variables

Motor Ability Components

1. Speed
2. Explosive Power
3. Endurance
4. Arm Strength

Physiological Variables

1. Resting Pulse Rate
2. VO₂ max
3. Anaerobic Power
4. Breath Holding Time

3.2.2 Independent Variables

1. 80% of 1 RM Intensity for two days in a week (High Intensity with Low Frequency) for twelve weeks.
2. 60% of 1 RM Intensity for three days in a week for (Low Intensity with High Frequency) twelve weeks.

3.3 EXPERIMENTAL DESIGN

The study was formulated as a true random group design, consisting of a pre test and post test. The subjects (n=60) were randomly assigned to three equal groups of twenty athletes each. The groups were assigned as Experimental Groups I, II and control group respectively. Pre tests were conducted for all the subjects on selected motor fitness and physiological variables such as speed, explosive power, endurance, arm strength, resting pulse rate, VO₂ max, Anaerobic power and breath holding time. Eight selected weight training exercises were selected for the study and 1 RM (Repetition Maximum) of the weight training exercises were determined for experimental group subject. The experimental groups participated in their respective high intensity (80% of 1 RM) low frequency (2 days per week) weight training and low intensity (60% of 1 RM) and high frequency (3 days per week) weight training a period of twelve weeks.

The post tests were conducted on the above said dependent variables after the experimental period of twelve weeks for all the three groups. The difference between the initial and final scores of the subjects on each variable was the effect of respective treatments. Statistical significance was tested through applying ANCOVA.

3.4 PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects in order to fix the exercise load. For this purpose ten athletes, who were not the subjects for this study were selected and selected weight training exercises were given to them.

Based on the response of the subjects in the pilot study, training programme to ensure the suitability fixed, determination of 1 RM, 80% of 1 RM and 60% of 1 RM loads and duration of exercise were scheduled.

Further the pilot study helped to know the subjects' capacity, to know the satisfactory effects of exercises and to know the difficulty of conducting training programme and to set a clear understanding about the duration of time which was required for conducting the test.

Thus, training schedules for experimental group I and experimental group II were constructed. However, the individual differences were not considered. This enabled the investigator to adapt suitable training schedule for this study

3.5 CRITERION MEASURES

The following criterion measures were adopted to measure the test.

1. To find out the effect of 50 meters run, conducted by using stop watch and the scores are recorded in seconds.

2. To find out the explosive power of the subjects standing broad jump test was conducted.
3. To find out the endurance of the subjects Cooper's 12 minutes Run / Walk test was measured.
4. To find out the arm strength pull ups test was conducted.
5. Resting pulse rate was determined through the radial artery beats and counted in numbers per minute.
6. To find out VO_2 max Cooper's test was conducted.
7. To find out Anaerobic Power, Margaria Kulamen Test was administered.
8. To find out breath holding time of the subjects, nose clip and stop watch was used.

Table I shows the variables selected, test administered and the unit of measurements of the study.

Table I
Showing the Variables, Tests and Unit of Measurements for the Study

S.No	Variables	Tests	Unit of Measurement
1	Speed	50 M Sprint	Seconds
2	Explosive Power	Standing Broad Jump	Meters
3	Endurance	Cooper's 12 Minutes Run /Walk	Meters
4	Shoulder Strength	Pull ups	Number
5	Resting Heart Rate	Palpation Method	Beats/per minute
6	VO ₂ max	Cooper's Test	ml/Kg
7	Anaerobic Power	Margaria Kalemien	ml . kg ⁻¹ . min ⁻¹
8	Breath Holding Time	Manual	Seconds

3.6 RELIABILITY OF DATA

Before the commencement of experiment, the reliability of the data were established through reliability of instruments, tester's reliability and subjects reliability by test and retest method.

3.7 RELIABILITY OF INSTRUMENTS

The research scholar used the following instruments for measuring various tests, stop watch, measuring tape, starting clapper, were used to find out the reliability of the instruments. Further those instruments has been calibrated in standard units, each of the variables are recorded. All the instruments were in good

working condition. Their calibration were tested and found to be accurate enough to serve the purpose of the study.

3.8 TESTER'S RELIABILITY

To determine the reliability of measurements involved in this study, the data were collected from the athletes of three groups. To ensure that the investigator was well versed in the technique of conducting the tests, the investigator had a number of practice sessions in the testing procedures. The investigator took all the measurements with the assistance of persons well acquainted with the tests and their procedures. Tester's competency and reliability of tests were established by Test, retest, process. As very high correlation was obtained, the tester competency in taking measurement and test reliability were accepted.

3.9 SUBJECT RELIABILITY

To determine the reliability of the subjects the athletes were selected as subject and divided into three groups as control group, experimental group I and experimental group II. The test conducted for tester's reliability ensured the subject reliability.

The correlation of coefficient correlation obtained for the tests variables are given in Table II.

Table II
Intra Class Correlation Coefficient of Test – Retest Scores

S.No	Variables	Coefficient of Correlation
1	Speed	0.93*
2	Explosive Power	0.92*
3	Endurance	0.992*
4	Arm Strength	0.91*
5	Resting Pulse rate	0.87*
6	VO ₂ max	0.86*
7	Anaerobic Power	0.88*
8	Breath Holding Time	0.87*

* Significant at 0.05 level

3.10 TRAINING PROGRAMME

The interventional treatment for experimental group I, high intensity low frequency weight training and experimental group II low intensity and high frequency weight training for twelve weeks were given. In order to give the percentage of load, the subjects were determined of their 1 repetition maximum using the following method.

3.10.1 DETERMINATION OF ONE REPETITION MAXIMUM (1 RM)

Purpose

To determine one repetition maximum (1 RM)

Equipment

Barbells with weights

Procedure

The subject was asked to perform weight lifting with 30 Kgs weight (randomly fixed sub-maximal weight) in each weight lifting method. For example, in the snatch the subject started the initial drive which comes from the hip, gluteal, and quadriceps muscles. The bar proceeded upward and the torso stayed roughly at the same angle when the lifter set up. The lifter then extended their body when the barbell reached his pelvis. This extension created enough force that propelled the barbell upwards while the lifter dropped underneath to catch the barbell. Then the lifter would recover and stand up with the barbell. This would be repeated as many times as the subject could.

Scoring

1 RM was determined through Brzycki Formula (Brzycki, 1998) as detailed below:

$$1 \text{ RM} = w / [1.0278 - (0.0278 \times r)]$$

where 'w' was the weight and 'r' was the number of repetitions.

In the same manner 1 RM would be determined for each subject before the experimental treatment for the following weight lifting exercises:

- a. Military press
- b. Barbell curls
- c. Bench press
- d. Lying Triceps Extension
- e. Barbell Rows
- f. Squats
- g. Standing calf Raises
- h. Leg Press

3.11 DESCRIPTION OF WEIGHT LIFTING EXERCISES

The description of the weight lifting exercises performed by the subjects of high intensity and low frequency weight training and low intensity and high frequency weight training were given below.

3.11.1 MILITARY PRESS

Initial Position

The subject was asked to hold the bar a little more than shoulder width, palms facing away, with bar resting across the front of the shoulder as shown in Diagram I.

Diagram I: Initial Position of Military Pres



Movement and Final Position

The subject was asked to push the barbell directly up past the face until arms locked out straight and the barbell was directly above the head. Slowly lowered the barbell back to the starting position and repeated the movements for the required numbers of repetitions. The final position of the military press position as shown in Diagram II.

Diagram II: Final Position of Military Press



Caution

Care was taken that the subject not to bend backward like press the weight upward, which made the movements easier to complete.

Benefits

This exercise developed the deltoid and triceps muscles with secondary emphasis on the upper pectoralis, trapezius and back muscles.

3.11.2 BARBELL CURLS

Initial position

The subject stood erect with a shoulder-width grip on barbell, palms facing away from the body. Upper arms were pinned to the sides of torso throughout the movement. At the start of the movement, arms were straight and the barbell should be resting across the upper thighs, as shown in Diagram III

Diagram III: Initial Position of Barbell Curl



Movement and Final Position

Keeping the upper body straight, slowly raised the weight toward the chest, pause and returned slowly to the initial position. The Diagram IV showed the final position of barbell curl.

Diagram IV: Final Position of Barbell Curl



Caution

Care was taken that the subject did not rock or move the upper body during this exercise, which were performed for bulking up the biceps. The subjects were asked to keep the biceps under tension throughout.

Benefits

This movement developed the biceps and also develops the forearms muscles.

3.11.3 BENCH PRESS

Initial position

The subject was asked to lie on the back on a flat exercise bench, took a slightly wider than shoulder-width on a barbell, palms facing upward. Arms were straight and the barbell supported directly above the chest, as shown in Diagram V.

Diagram V: Initial Position of Bench Press



Movement and Final Position

Lowered the weight slowly till it just touched chest and raised bar again to initial position, and the subject was asked to repeat the same for the suggested number of repetitions as shown in Diagram VI.

Diagram VI: Final Position of Bench Press

**Caution**

The subject was asked to perform it slowly with bouncing the weight; and asked not to deviate from the correct procedure so as to avoid injury.

Benefits

This exercise added bulk to all chest muscles. Bench press develops the pectorals, deltoids and triceps muscles.

3.11.4 LYING TRICEP EXTENSION

Initial position

The subject was asked to take the same starting position as far the bench press, except that he used narrow grip (six inches between the index fingers) in the middle of the barbell, as shown in Diagram VII.

Diagram VII: Initial Position of Lying Triceps Extension



Movement and Final Position

Keeping the upper arms motionless, slowly bending the elbows the subject was asked to move the barbell in a semicircular arc until it touched the forehead or went back over the end of the bench. Returned the barbell along the same arch to the starting position and repeated for the required number of repetitions. as hown in Diagram VIII.

Diagram VIII: Final Position of Lying Triceps Extension



Caution

The subject was asked to perform it slowly with bouncing the weight; and asked not to deviate from the correct procedure so as to avoid injury.

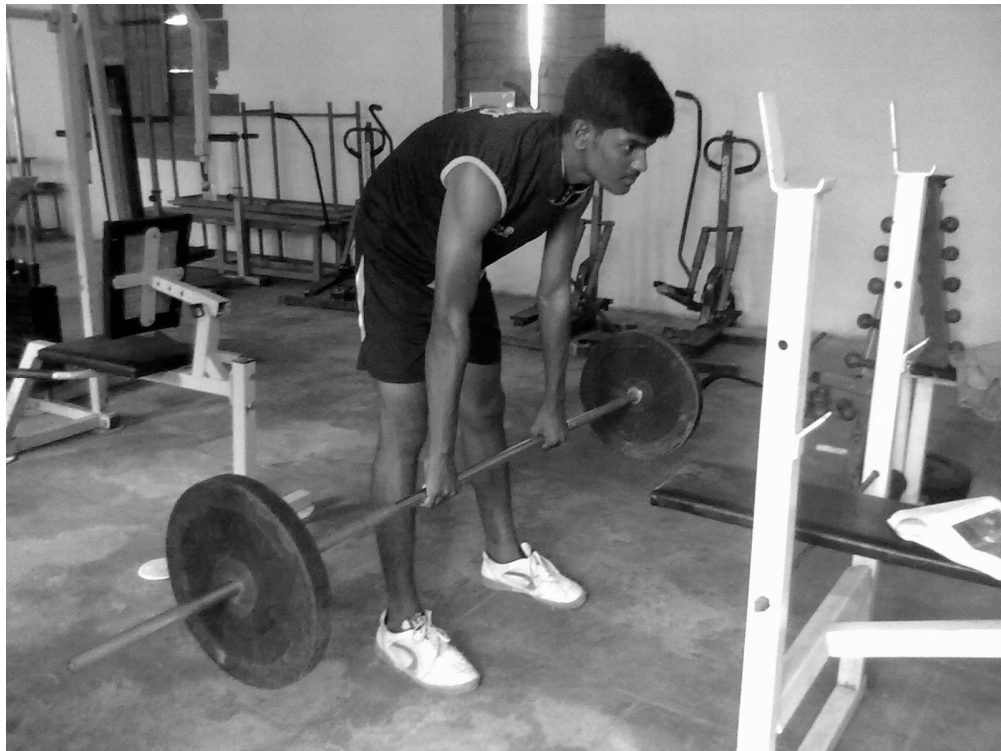
Benefits

This exercises developed the triceps muscle.

3.11.5 BARBELL ROWS**Initial Position**

The subject was asked to assume the position, keeping hands shoulder-width, bend over grasp the bar, as shown in Diagram IX.

Diagram IX: Initial Position of Barbell Rows



Movement and Final Position

Moving just forearms, bend the arms and the subjects were asked to move the barbell in a semicircle from the thighs towards the chin. Slowly lowered the weight along the same arc back to the starting position and the exercises were repeated, as shown in Diagram X.

Diagram X: Final Position of Barbell Rows.



Caution

The subject was asked to keep the upper body motionless when curled the weight. Lower the bar fully (arms hanging straight down) after having curled it to the top of the movement. The subject was asked to perform a full range of motion for each repetition.

Benefits

This exercises developed the biceps and also developed the forearms muscles.

3.11.6 SQUATS**Initial Position**

The subject stood erect with a barbell behind his neck, balancing it across the shoulders by grasping the bar near the plates, placed the heels about 15-20 inches apart, toes angled slightly outward, as shown in Diagram XI.

Diagram IX: Initial Position of Squats



Movement and Final Position

The subject fixed the eyes on a point in front slightly above eye level and kept them there throughout the movement. Then slowly bent the knees and lowered the body into a full squat. Once the thighs had gone past parallel, then slowly rose up to the starting position, as shown in Diagram XII.

Diagram XII: Final Position of Squats



Caution

The subjects were asked to keep the feet flat. To make the balance more secure by resting the heels on a 2 x 4 inch board during the movement.

Benefits

This was one of the best exercises, because it affects most of the major muscle groups of the body. The squat worked the thigh muscles, hips and gluteous, hamstrings and lower back. The abdominal muscles, upper back, calves and shoulders were stimulated too. Hence, it was called the king of exercises.

3.11.7 STANDING CALF RAISES

Initial Position

The subject placed a barbell behind the neck, balancing it as did when performing a squat. Stood with toes and the balls of feet on a 4 x 4 inch or 2 x 4 inch block of wood. The feet was about 8-10 inches apart, as shown in Diagram XIII.

Diagram XIII: Initial Position of Standing Calf Raises



Movement and Final Position

Keeping the legs straight, rise up as high as possible on toes. Lower slowly back to the starting point and repeated, as shown in Diagram XIV.

Diagram XIV: Final Position of Standing Calf Raise**Caution**

Care was taken to balance and slowly rise up.

Benefits

This movement stretched the gastrocnemius and soleus muscles of calves and also develops both muscles.

3.11.8 LEG PRESS**Initial Position**

The subject was asked to lie down in supine position on the machine with back flat against the back rest and feet on foot plate about twelve inches apart, with toes pointing slightly outward. Gripped the handles as shown in Diagram XV.

Diagram XV: Initial Position of Leg Press



Movement and Final Position

The subject was asked to fold legs slowly bending the knees and moving them towards chest. Let the weight came as low as possible and then pushed the weight back and extended legs fully to return to the initial position. Repeated the same for the desired number of repetitions, as shown in Diagram XVI.

Diagram XVI: Final Position of Leg Press



Caution

Care was taken to see that the back and shoulders must remain flat against the back rest throughout, to work the inner thigh more, kept the legs apart a little more. Did it slowly that will help to avoid injury to the knees.

Benefits

This was the best isolation movement for stretching and developing the quadriceps.

3.12 TEST ADMINISTRATION

Administration of the tests and the method of collecting the data were explained here.

3.12.1 MOTOR ABILITY COMPONENTS**3.12.1.1 Speed (50 Meters)****Purpose**

To measure the speed

Materials used

Two stop watches, measuring tape, clapper, track marking 50 meters

Instruction

The subjects were advised to run in their own lane from the starting to finish, with maximum speed. The command used for starting was 'on your mark', 'set,' 'clap.'

Procedure

Two lines were marked 50 meters apart from the starting line and finish line. On the command, followed by 'clap', the subjects ran as fast as possible across the finish line to cover 50 meters distance.

Scoring

The elapsed time was measured to the nearest one tenth of a second.

3.12.1.2 EXPLOSIVE POWER**Purpose**

To measure leg explosive power

Procedure

The subject was asked to stand behind the take off line. The subject had to flex his knees and the extended arms taken behind. The arms were swing back and forth and subject, taking off with toes, fully extending the knees was to leap forward into the broad jump pit as far as possible. Three trials were given and the best jump was recorded in centimeters.

3.12.1.3 ENDURANCE (12 Minutes Run / Walk)**Objective**

To measure the endurance

Facilities and Equipments

Track, marked area, stop watch.

Test Description

Subjects could run individually or in groups of a dozen or more. When students ran in groups, they were paired. While 9 subjects ran the partners listened for the distance covered to call out his partner's distance when he crossed the finish line, and then relay this distance to the scorer. Subjects entered space running with periods of walking and were encouraged to pace themselves. When a group was running, the distance was called out as each student crossed the finish line. The score was the distance covered for 12 minutes either by run or walk. .

3.12.1.4 ARM STRENGTH**Objective**

To measure the arm strength.

Apparatus used

A mat or a clean and leveled floor.

Procedure

From a straight arm front leaning rest position.,the performer lowered the body until the chest touched the mat and then pushed upward to the straight arm support. The exercise continued for as many repetitions as possible without rest. The body did not sag upward but maintain a straight line, throughout the exercise.

Scoring

The score was the number of correct push ups executed without rest (Allyn and Bacon, 1997).

3.12.2 PHYSIOLOGICAL VARIABLES

3.12.2.1 RESTING PULSE RATE

Objective

The purpose of this test was to record the number of heart beat per minute.

Equipment

A stop watch (1/100 of a second) and a chair.

Procedure and Scoring

The resting heart rates of all the subjects were recorded in sitting position in the morning session. Before taking the resting heart rate, the subjects were asked to sit in a chair inside a room and relax for 20 minutes. To record the heart rate, finger tips were placed on the radial artery at the subjects wrist in such a manner that palpation was clear and the number of palpation was counted for one minute.

3.12.2.2 VO₂ MAX

Purpose

To measure the VO₂ max of the subjects

Equipment

Whistle, stopwatch, 400 meters track.

Description

Subjects assembled behind the starting line .At the starting signal, they were asked to run or walk as far as possible with in the 12 minutes time limit. An experienced pacer should accompany the subjects around the running area during the actual test. At the signal 'to stop 'subjects should remained where they finished long enough for test administrators to record the distance covered. Ample time was given for stretching and warm-up as well as cool down.

Scoring

The distance in meters covered in 12 minutes. The VO_2 max in ml/min/kg was calculated based on the formulae suggested by Cooper (1960) was:Where, d_{12} from the distance (in meters) covered in 12 minutes.

3.12.2.3 MARGARIA – KULAMEN POWER TEST TO MEASURE ANAEROBIC POWER**Purpose**

To measure the immediate anaerobic power out put.

Procedure

The subjects began at point A and ran as rapidly as possible up a flight of stairs taking three steps at a time. The time to cover the distance between stair 3 and stair 9 was recorded to the nearest one hundredth of a second.

Scoring

Power output was the product of the subject's weight (F) and vertical distance (D) divided by the time (T) which can be represented by the following formulae (Mc Ardle et.al. 1996):

$$\mathbf{P = F \times D / T}$$

3.12.2.4 BREATH HOLDING TIME

Objective

The purpose of this test was to measure the breath holding time.

Equipments

For recording the breath holding time, a stop watch (1/10th of second) and nose clip were used.

Administration

The subject was instructed to stand at ease and to inhale deeply after which he held his breath for a length of time possible by him. A nose clip was placed on nose to avoid letting the air through nostrils. The duration from the time of holding his breath until the movement he let air out was clocked by using the stop watch to the nearest one tenth of a second as breath holding time. The co-operation of the subject to let out the air by opening the mouth was sought to clock the exact breath holding time.

Scoring

The time has recorded in seconds and the beset of two trials were recorded (Mathew, 1988)

3.13 COLLECTION OF DATA

The data was collected on the selected items as per the methods described above. The pre test was organized before the experimental period and after 12 weeks of experimental period post test was organized and data was collected for the study.

3.14 STATISTICAL TECHNIQUE

To find out the effects of high and low intensities of weight training on motor components and physiological variables, the pre test scores were analysed by using ANACOVA statistical technique. When the F ratio was found to be significant, Scheffe's post hoc test was to find out the paired mean significant difference. (Thirumalaisamy, 1998).